RESEARCH AND DEVELOPMENT LABORATORY

September 1966

I. GENERAL

1. On 12 September the Laboratory conducted a comprehensive tour for a group of twenty-seven professional recruiters accompanied by Mr. [redacted] Subsequently, on 15 September, as a part of the Office of Communications presentation to the support services school, the Laboratory played host to fifty-six personnel representing various offices of the DDS. 25X1A9a

2. Messrs. [redacted], Laboratory design engineers, journeyed to [redacted] this month in connection with field evaluations conducted on the [redacted] roadwatch transmitter system. 25X1A9a 25X1A6a 25X1A2g

3. The value of equipment fabricated at the R&D Laboratory and delivered to the warehouse for stock during September was $65,090.

II. DESIGN

1. New projects initiated during September include requirements for the KA/A-2 keyer adaptor and a new pulsed gallium arsenide infrared communications system. [redacted] One prototype will be fabricated and forwarded to [redacted] for operational testing. The gallium arsenide infrared communications system is intended to enhance the capability of the Office of Communications to provide enciphered staff communications for institutional cover situations. The new system will enable transmission of enciphered voice, printed pages, and pictures over an invisible beam of light with a signal bandwidth of over 20 kHz and an operating range from 2 to 3 miles or more. 25X1C8a 25X1C8a 25X1C8a 25X1A6a

2. Two additional investigative-type design projects were started during this reporting period. One, to consider a method suitable for refurbishing the [redacted] built agent transmitter in order to make the unit operationally acceptable. The second, to investigate the cause of deficient and often erratic operation of the Spotmaster 25X1A5a1

recorder presently in use throughout the world in medium-speed receive positions. The intent of this project is to devise a field modification work order to correct those deficiencies which have been discovered.

3. A comprehensive field evaluation of the [redacted] roadwatch transmitter was conducted this month in [redacted] and [redacted] A communications/SAVA team including two Laboratory engineers has been operating the two [redacted] units under closely simulated operational conditions in [redacted] with reasonably satisfactory results. Operational techniques are being evaluated as well and some minor modifications have been recommended. Feasibility of training team members by local operating personnel has also been proven. Ten units providing 17 information categories plus a 2-digit wired-in ident signal will be fabricated on a crash basis to be ready for delivery on or about 1 November, followed by a production run of approximately 100 additional units.

25X1A2g
25X1A6a
25X1A6a
25X1A2g
25X1A6a

4. The [redacted] field station; i.e., the agent portion of the satellite communications system was completed in prototype form at the Laboratory late this month and will undergo environmental and technical evaluations during the next reporting period. The [redacted] field station is composed of five integrated subsystems including a circular polarized antenna, transmitter, sequencer, coder/keyer, and [redacted]

25X1A2d1
25X1A2d1
25X1C1e

a. The solid-state transmitter provides a phase-modulated 5-watt carrier output at 166 MHz operating from a 12 volt dc power supply. Also included in this package is the sequencer and a subcarrier oscillator containing circuitry for either CW or biphase keying.

b. The antenna system provides a radiation pattern which is omnidirectional in the horizontal plane and circularly polarized. Circular polarization is accomplished [redacted]

25X1C1e

c. The sequencer enables the subcarrier and coder/keyer for ten seconds after activation of the transmitter and turns the system off two seconds after the keying cycle is complete.

d. The coder/keyer will be the solid-state CK-28 and the power supply will consist of 500 mA hour 12 volt dc nickel cadmium batteries for the transmitter and a 180 mA hour 28 volt dc supply for the coder/keyer.

III. ANALYSIS AND APPRAISAL

1. Four evaluations were published and distributed during September. Six other evaluations were completed and the reports written. These are in process of being published. Seven evaluations are presently in the testing phase.

2. The RMC 2X4/TNF-2 receiver multicoupler was developed and manufactured by [redacted] 25X1A5a1 Virginia. The unit accepts the inputs from two antennas and provides outputs for four receivers on each antenna. Frequency range is 2 to 30 MHz. The power supply is common to both sections. A tunable passive notch filter is used in each section or the filters can be connected in series on one section to eliminate unwanted signals. Notch depth is variable to -50 db. The unit met specifications in all areas except noise figure, rejection of signals below cutoff, and intermodulation which was slightly below specification. Although the unit is useable in its present form, correction of the aforementioned deficiencies are recommended to provide a really desirable piece of equipment.

IV. FABRICATION

1. The first of five new production projects initiated this month provides for fabrication of 200 AN-74 agent dipole antennas. Fifty of these units are required on a priority basis for use in [redacted] 25X1A6a

2. The second new project calls for assembly of 24 TK-1 training kits designed to provide agent training officers with a convenient system comprised of the equipment normally used for medium-speed communications training. The TK-1 will

contain a UHER 4000 model tape recorder Laboratory-modified for a 17 to 1 speed ratio, along with a RR-49 receiver, a TE-2 Morse code training unit and appropriate accessories. The entire system will be packaged in an attache case.

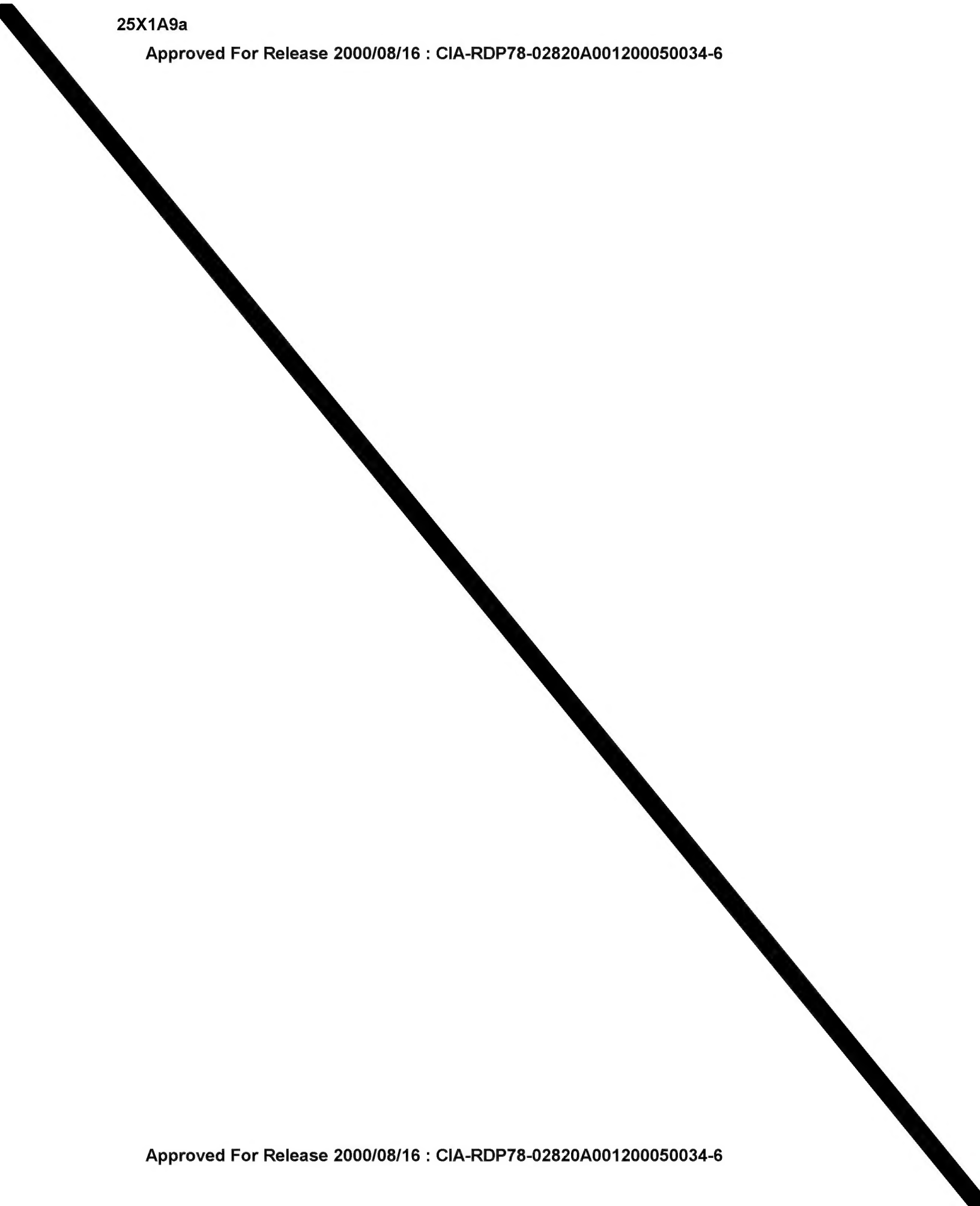
3. The third fabrication project is for 25 RR-48E agent receivers. The RR-48E is a conventional RR/B-48 transistorized crystal-controlled agent receiver converted to cover a lower frequency range of 3 to 12 MHz.

4. The fourth new fabrication project provides for building 20 RS-526 personnel alerting systems. The RS-526 consists of a GE Porta-Mobil transceiver operating with a Laboratory-built CU-20 tone generator to provide radio frequency signals to trigger a Motorola Page Boy receiver which has been modified to enable the selection of audio, visual or cutaneous alarm techniques. The cutaneous alarm position of this system consists of a Peltier effect cell worn on the body which momentarily turns ice cold when triggered by the Page Boy receiver.

5. The fifth fabrication project consists of the requirement for producing, on a crash basis, 10 [redacted] roadwatch transmitters described previously in the design section of this report. 25X1A2g

6. One project was completed this month with the delivery of five CV-13E converters to the warehouse for stock. The CV-13E is used in the medium-speed base station receive position to convert the receiver IF output to 10 kHz which is then recorded at high speed and provides audible tone when slowed down for manual readout playback.

7. Projects resulting in partial delivery of equipment to the warehouse for stock this month include 85 CC-15 crystal cases, 1 RS-72 transceiver, 72 HG-48A handcrank generators, 50 CL-48 universal clamps for use with the HG-48A, 10 RS-522 body-worn ELD systems and 900 CT-1 universal line cords.



EXTERNAL PROJECTS SECTION

September 1966

I. PROJECTS

1. AS-12 FIELD TESTS

The AS-12 is a 10,000 word-per-minute agent HF communications system intended for use over 500 to 2000 km paths. In operation, the base listens to a number of frequencies to locate clear channels. A sounding pulse train is then transmitted on these clear channels. The agent equipment listens on each of a number of pre-assigned frequencies to locate the sounding pulse train. When located, the equipment makes an analysis of both signal amplitude and absence of multipath distortion. If previously established criteria are met the agent equipment will automatically transmit the message.

25X1A5a1

In June of 1964, [redacted] began the development of the AS-12 hardware. This hardware was completed late this past spring. The base equipment was installed at [redacted] and the installation was checked over a [redacted] link.

25X1A6b

25X1A6b

We are presently in the midst of extensive field testing of the AS-12 system. The primary objectives of the field test program are to:

a. Demonstrate performance of the equipment in an operational environment.

b. Measure the performance of the system under typical and extreme operating conditions (extreme conditions include under range, over range, thunderstorm, and sudden ionospheric disturbances).

c. Identify and understand the causes affecting the measured results (and use this information to predict system operation using prediction charts).

We think we are going about this on a sound, thorough, scientific basis.

d. Make recommendations for operational, system, and equipment improvements. The agent equipment will be operated from the following sites:

| Location | Range | Number of Days |
|---|---|---|
| Balpre, Ohio | 300 km (under range) | 4 |
| Wilmington, Ohio | 500 km | 10 |
| Springfield, Illinois | 1000 km | 15 |
| St. Joseph, Missouri | 1500 km | 15 |
| Benkelman, Nebraska | 2000 km | 15 |
| Rifle, Colorado | 2500 km (over range) | 10 |

A Granger oblique ionospheric sounder is being operated over the same link and at the same time as the AS-12 system. The data obtained from this sounder will be used to relate system performances to prevailing ionospheric conditions. Information on frequency dependency, presence and effect of sudden ionospheric disturbances and sporadic "E" layer effect will, thus be made available.

As of this writing, tests have been completed from Balpre, Ohio, and Wilmington, Ohio. Data is still in raw form so that intelligent conclusions cannot yet be drawn. However, the following is representative of the type of operation we are experiencing. For a four day period at Wilmington, Ohio, the field unit transmitted 205 times. One hundred and seven of these messages were received at the base with 1 percent or less error rate. 11

2. CK-30 CODER/KEYER

The CK-30 is a miniature electromechanical coder/keyer which features the provision of coder, keyer, and magnetic tape memory within one small package, thereby eliminating external cabling and minimizing size and weight. It has a rechargeable internal battery for use during read-in operation. When used to key a transmitter, the CK-30 requires 12 volts and about 140 mA from an external source. Two versions of the CK-30

It should be noted that 1% error rate is probably too restrictive for an operational system and 4% would be acceptable with a much higher sending rate. ##

have been developed. One keys at 300 wpm Morse and the other at 1200 wpm Baudot (the Baudot unit has been designated the CK/A-30). Both units can store up to 300 groups.

25X1A5a1

A contract was awarded to [redacted], for the development of this equipment in June 1964. An engineering model and three service test models of both the Morse and Baudot units have been delivered. We are currently awaiting the manufacturer's proposal for setup and tooling of a production run.

3. RS-101 RADIO SET

The RS-101 is being developed in order to meet a long-standing requirement to replace the RS-1. The RS-101 will be significantly more than a replacement, however; it provides both transmitter and receiver within an integral package, and it offers voice, manual CW, and medium speed CW operation. Basically, it is a 2 to 24 MHz solid-state radio intended for paramilitary operations.

The semiautomatically tuned transmitter produces 20 watts in the CW mode and 5 watts in the AM mode. The receiver is capable of receiving AM, CW, or SSB signals. There are provisions for a battery and either a synthesizer or crystal matrix.

25X1A5a1

A contract was awarded to [redacted] on 12 October 1965, for five service test models, subject to our acceptance of an engineering model. This engineering model was received this summer, and the fabrication of the five service test models began in early September. Delivery is scheduled for November 1966. Mid-November *

4. RS/J, K, L, & M - 509 ELECTRONIC LETTER DROP SYSTEMS

25X1A5a1 [redacted] delivered the last of these four ELD packages this month. These units will be used for tests, demonstrations, and occasional training in the local metropolitan area. However, construction, reliability, and operation are such that the packages can be operationally used if the requirement arises.

Depending on which of the four packages is selected, the user has options for 300 or 1200 wpm operation with the KE-8 or KE-29

* Hold your breath Harry!

equipment respectively. Medium-speed operation (300 wpm) is provided in the 28 to 35 MHz spectrum with a choice of the older RT-42 or the more recently developed RT-57. Either 300 or 1200 wpm capability can be selected within the 150 to 170 MHz spectrum which is covered by the RT-60 1 watt transmitter.

5. RT-66 AGENT RADIO TRANSMITTER

We received an original prototype of the RT-66 in 1965. The unit now under development, designated RT-66P2, features semiautomatic tuning. It is a solid-state 3 to 24 MHz transmitter intended for clandestine operation. It is powered directly from a 12 volt dc source and provides an RF power output of 20 watts; a small button-type key is integral to the unit; and the output network provides antenna matching over a wide impedance range.

25X1A5a1

A contract was awarded to [redacted] on 26 October 1965, for the RT-66P2. The engineering model was received during the past summer, and fabrication of the service test models commenced during September. Delivery is scheduled for late October. A unique feature of this small transmitter is the provision of forward and reflected power measuring circuitry which serves both to provide "matching" information to the automatic tuning network and to stabilize power output through automatic load control techniques.

25X1A2d1

6. SATELLITE AGENT COMMUNICATION SYSTEM [redacted]

25X1A5a1

A contract was awarded to [redacted] in June 1965, for the final development, fabrication, and testing of two satellite payloads together with one ground control station. Phase I of this advanced clandestine communication development consisted of a dual development of prototype satellite payloads; following the test program, the [redacted] 25X1A5a1

25X1A5a1 [redacted] model was selected.

25X1A9a

During September Messrs. [redacted]

25X1A6a [redacted] engineer; and [redacted], attended acceptance tests 25X1A9a for the ground control station.

7. AC-3 HF ANTENNA COUPLER

25X1A5a1

A contract for the procurement of AC-3's was initiated 29 March 1965, with [redacted], but delivery of the first two

preproduction units was delayed by a change in power capability requirements. The first two preproduction units were approved in August 1966, and authorization was given to proceed with production of 98 production models.

In accordance with our standard practice for expediting the acceptance of new production equipment, Mr. [redacted] 25X1A9a
25X1A9a accompanied Mr. [redacted] T&I representative, to the plant in September to review and coordinate T&I procedures for the AC-3.

Fifty of these units were shipped in September, and the remaining 48 units are scheduled for delivery in October. Each AC-3 is being shipped with operating spares, and unique spare parts are being provided for stock as part of this same contract. We have found that procuring unique spare parts for stock as part of a first production contract greatly eases the first two years of spare part support.

The AC-3 matches (VSWR less than 2:1) a broad range of antenna impedances to a 50 ohm transmission line; requires manual operation; handles 400 watts of continuous RF power; monitors forward and reflected power; contains protective circuitry to deenergize the transmitter under predetermined malfunction conditions; and contains an internal 50 ohm dummy load.

II. ADMINISTRATIVE

TDY

25X1A9a [redacted]

| | |
|---|---|
| Fort Wayne, Indiana | 8 September |
| Chicago, Illinois | 15 September |
| Cincinnati, Ohio | 20 September |
| Northfield, Minnesota | 12 September |
| Princeton, New Jersey | 16 September |
| Stockton, California | 19 September |
| Mountain View, California | 20 September |
| Torrance, California | 23 September |
| Boston, Massachusetts | 14 September |
| Cincinnati, Ohio | 19 September |
| Dallas, Texas | 21-22 September |
| Redondo Beach, California | 23-28 September |
| Newport Beach, California | 20 September |